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Proceedings of the Canada / US Information Session on Spiny Dogfish

Compte rendu de la séance d'information Canada-États-Unis sur l'aiguillat commun

4 April 2003 | **Le 4 avril 2003**

George Needler Boardroom
Bedford Institute of Oceanography
Dartmouth, Nova Scotia

Salle de conférences George Needler
Institut océanographique de Bedford
Dartmouth (Nouvelle-Écosse)

Alida Bundy
Meeting Chairperson / Président de réunion

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Dartmouth, Nova Scotia / Dartmouth, Nouvelle-Écosse
B2Y 4A2

May 2003

Canada

FOREWORD

The purpose of these proceedings is to archive the activities and discussions of the meeting, including research recommendations, uncertainties, and to provide a place to formally archive official minority opinions. As such, interpretations and opinions presented in this report may be factually incorrect or mis-leading, but are included to record as faithfully as possible what transpired at the meeting. No statements are to be taken as reflecting the consensus of the meeting unless they are clearly identified as such. Moreover, additional information and further review may result in a change of decision where tentative agreement had been reached.

AVANT-PROPOS

Le présent compte rendu fait état des activités et des discussions qui ont eu lieu à la réunion, notamment en ce qui concerne les recommandations de recherche et les incertitudes; il sert aussi à consigner en bonne et due forme les opinions minoritaires officielles. Les interprétations et opinions qui y sont présentées peuvent être incorrectes sur le plan des faits ou trompeuses, mais elles sont intégrées au document pour que celui-ci reflète le plus fidèlement possible ce qui s'est dit à la réunion. Aucune déclaration ne doit être considérée comme une expression du consensus des participants, sauf s'il est clairement indiqué qu'elle l'est effectivement. En outre, des renseignements supplémentaires et un plus ample examen peuvent avoir pour effet de modifier une décision qui avait fait l'objet d'un accord préliminaire.

103-07382/

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ABSTRACT

The first spiny dogfish (*Squalus acanthus*) information session was held at the Bedford Institute of Oceanography on 4 April 2003 and provided a forum for Canada and US Science, Management and Industry to exchange data, knowledge and understandings about spiny dogfish biology, fisheries and management. This meeting was recognised as the first step in a process to work towards a more integrated management of the spiny dogfish.

RÉSUMÉ

La première séance d'information sur l'aiguillat commun (*Squalus acanthus*) s'est tenue à l'Institut océanographique de Bedford le 4 avril 2003. Elle constituait pour les scientifiques, les gestionnaires et les représentants de l'industrie du Canada et des États-Unis l'occasion d'échanger des données et des connaissances sur la biologie, la pêche et la gestion de l'aiguillat commun. Cette rencontre a été considérée comme la première étape d'un processus visant à établir une gestion plus intégrée de l'aiguillat commun.

INTRODUCTION

The Chair, Alida Bundy, opened the meeting by greeting the participants (Appendix 1) and invited the participants to introduce themselves. She then explained that the purpose of this meeting was to exchange data, knowledge and understandings about spiny dogfish (*Squalus acanthus*) biology, fisheries and management. The need for a meeting arose during Canada / US Steering Committee meetings when the US expressed concern about Canada's approach to dogfish management. Spiny dogfish is a species of shark that resides off the North East Atlantic coasts of both Canada and the USA. It has over the years been bycatch to fisheries in both countries and more recently subjected to targeted exploitation. It was agreed that a first step towards resolution of any issues raised would be a joint meeting, hosted by Canada, to exchange information and views on dogfish biology and its management in both countries.

The chair explained that the meeting would consist of a series of presentations (Appendix 2) on spiny dogfish, based on existing knowledge, enhanced where possible with more recent observations. Ample time would be allowed for discussion. Two participants, Peter Hurley and Peter Comeau, had agreed to rapporteur the morning and afternoon sessions of the meeting. The presentations are available in Appendix 3.

In the text below, the discussion by each presentation topic is provided. This is not intended to be a verbatim transcript but rather to be a record of the comments, questions and answers raised, as reported by the rapporteurs.

STOCK STRUCTURE, DISTRIBUTION AND SEASONAL MOVEMENTS

Presenter: Paul Rago

What is know about the diet of small dogfish?

Papers were published last year by Link and Garrison 2002 and Link, Garrison and Almeida 2002 summarizing stomach analysis of dogfish. Like many species, there was an ontogenetic change in diet, with a larger proportion of ctenophores, squid and other invertebrates in the diet of small dogfish and a larger proportion of fish in the diet of large dogfish.

What was the proportion of groundfish in the diet of dogfish and what is their impact on groundfish stocks?

The proportion of groundfish in the diet of dogfish is relatively small. Principle fish species in the diet of dogfish were silver hake and herring. There was a bigger impact on yellowtail than cod, because cod and haddock move out of an

area when dogfish move in while yellowtail do not. Dogfish have more of an impact on juvenile groundfish but interpretation of the data is complicated.

What was the impact of dogfish on cod and haddock spawning on Georges Bank?

Probably little impact as dogfish were generally not in the same area as cod and haddock during the spawning period. In the spring survey, dogfish are on the southern flank of the bank while cod and haddock spawning occurs up on bank. There would be more of a problem for cod in the fall when distributions are more similar. There is also a paper by Tsou and Collie (2001) examining interactions between dogfish and several other species on Georges Bank. There is an ontogenetic change in temperature and salinity preference in dogfish, with pups preferring colder temperatures. As a result, pups tend to occur offshore and in some years, are pushed into deeper areas. This will need to be factored into the next assessment.

The ECNASAP plot isn't accurate because it didn't indicate high abundance in the Bay of Fundy, but in the summer, the Bay is full of dogfish. The fishery concentrates in this area where there is a large proportion of large females in the catch.

There was an indication of high abundance off southwest Nova Scotia in the U.S. fall survey. The upper Bay of Fundy doesn't consistently get coverage in the Canadian summer RV survey. The fishery in the Bay of Fundy is usually August to November and the July RV may miss them.

In late July, August and September, dogfish are on the surface and the survey won't catch them.

Herring are spawning in the Bay of Fundy during this period.

Herring biomass has been increasing on Georges Bank, so has yellowtail. Has this had an impact on dogfish?

Predator/prey relationships are complicated, the dogfish diet is quite varied. It is difficult to separate the impact of fishery removals.

There appears to be a lack of information on dogfish pupping.

Yes, there's a lot to be learned. The RV survey provides some information but we need data from other times of the year.

What proportion of the dogfish stomachs were empty in the diet analysis?

Would have to check, stomachs are empty for a variety of reasons, this is taken into account in the analysis.

What was the estimate of the biomass of groundfish eaten by dogfish?

Will have to look up in Garrison et al. but mostly silver hake, herring and mackerel. More fish in the diet of larger dogfish, so as a result fish eaten mostly by large females.

GROWTH, REPRODUCTION AND MORTALITY

Presenter: Steve Campana

How many litters per female?

Not known at this time.

Is the southern pupping area in the Hudson Canyon area?

Yes.

What good are dogfish? It's as if Fisheries is protecting the wolves?

We don't know explicitly, that's hard to determine, but if dogfish are so abundant, the species must play an important role in the ecosystem. It's hard to predict the impact of removing dogfish, but we may not like what would happen. In other situations where major ecosystem changes have occurred, unpredictable and unexpected things have happened. We don't want to do that experiment.

A company in New England is manufacturing diet pills from dogfish livers. There are claims that a compound found in the liver allows them to only eat occasionally. Could this be related to empty stomachs in the diet study?

Not familiar with the compound or the product.

If the samples for the diet study were collected from dragger catches, rather than hook and line catches, the results will be biased.

In the summer, many fishermen see pregnant females with embryos with the yolk sac still attached. How close to birth are these embryos?

The yolk sac is absorbed before birth. Birth occurs in late winter off the U.S. coast.

If the average age in the Canadian catch is 20 years, what is the age when other species enter the fishery? With trout, the biggest fish takes the bait. Is the fact that the fishery is hook and line biasing the age composition or is it because of the age composition we have in our waters?

There was a hook size study conducted off Washington and British Columbia, but don't know results. The size selectivity in a hook and line fishery will be different than the RV survey which uses a small mesh liner in the cod end to ensure that it catches small fish.

There is nothing magical about 20 years, just a reflection of older slower growing fish. Average age of cod and haddock in the fishery is 5-6 years. The orange roughie is an extreme example of a slow growing fish, where it was determined after the species had been over-exploited, that there had been fish older than 100 years old in the population and stock recovery would be in the order of tens to hundreds of years.

What was the gear type used in the collapse in the U.S.?

Mainly mobile gear in the foreign fleet, none selective, mostly a reduction fishery.

Draggers are the most destructive fishing gear, hook and line fisheries are selective and in the handline fishery, discards are live.

Are dogfish from Upper Lahave Basin east to Newfoundland considered to be from the same stock?

The results of tagging studies and results from the RV surveys suggest that it is a single population.

Will there be more research conducted east of Lahave Basin?

Yes.

Sometimes one trip will all be females, the next will be males.

Like many sharks, dogfish school by sex and size; often encounter schools of mature females separate from mature males, separate from schools of immature males and females.

You didn't mention seals. Is there anything in the literature indicating whether seals eat dogfish?

Not aware of anything in the literature, will check with seal research colleagues.

TRENDS IN ABUNDANCE AND BIOMASS IN US AND CANADIAN WATERS

Presenter: Paul Rago

The average size of females in the Canadian RV survey is not decreasing. Why?

Interesting but don't know the reason why at this time. However the 2002 Canadian commercial size composition matches the U.S. commercial size composition.

Most of the fishery in the Bay of Fundy is within 1 mile of the shore. Does the RV survey cover the same area? Maybe the females are inside where the survey doesn't sample.

Are the ITQ survey patterns similar to the RV?

Yes.

The emphasis of the fishery is on large females. What is the survival of released fish? We should consider protecting the large females, like protecting berried lobsters. Re-direct the fishery to smaller fish and use a restrictive size limit to protect the breeding stock.

This is being considered, but there are concerns about survival of released fish, that hormonal changes caused by capture may result in mortality after release. This is being studied at present. A male only fishery was considered, but it didn't look like it would be effective.

Are males present in the pupping areas?

Don't know.

Average length of catch in US is less than 80cm and about 2kg. Canadian catch is smaller but the fish seem older. Why?

Canadian catch has a larger proportion of male fish. They grow slower and would be older for the same size female that is dominant in the US fishery. Also the ageing data are preliminary and more work on the age structure of the US and Canadian components of the population give a clearer view of the catch at age.

There have been collapses of dogfish stocks in other parts of the world. What has been the result?

They have come back but it took a long time. Has taken decades for some populations.

ASSESSMENT PLANS IN THE US AND CANADA

Presenters: Paul Rago and Steve Campana

Presentation Highlights

USA

The assessment is scheduled for review in June 2003 in the US Stock Assessment Review Committee (SARC). The Technical Subcommittee of the SARC will be meeting in May 2003.

The US Assessment will address, to the extent possible:

- Commercial and recreational catches
  - Biological sampling
  - Fisheries
  - At sea sampling
  - Special studies on discarding and survival

- Estimate current and historic fishing mortality and factors
  - Abundance estimates
  - Improved understanding of survey variability
  - Swept area estimators
  - Smoothing methods
  - Environmental associations
  - Mortality

- Biological reference points
  - Life history model to estimate target F
  - Effects of smaller size on entry
  - Reduced survival of the pups
    - Longevity
    - Stock/recruitment relationship
  - Estimate yield based stock status
  - Provide short term projections
  - Provide estimates of juvenile recruitment and pupping rates
  - Characterise level of discards, bycatch rates, discard mortality rates

A number of issues have been identified that need to be done in preparation for this assessment, including:

- Coordinate data exchange among US and Canadian researchers

- Summarise results of ongoing relevant studies
  - Discard survival
  - Reproductive biology
  - Tagging studies
  - Monitoring programs

- Facilitate/initiate special studies for biological information

Canada

The Canadian shark program will not be participating in the US assessment but will contribute data. The Canadian program will focus on the collection of more data over the next several years to put together a comprehensive stock assessment after the end of the 5-year data collection phase.

Discussion

Terms of reference seem large. Is it achievable?

The biggest challenge is the discard estimates. Because dogfish are caught in all fisheries this will be difficult. Since the fishery is small it may be tough to separate the effects of the fishery from the effects of by-catch on population trends.

There are only 4 plants that process dogfish in the Maritimes. It would be possible to get a great deal of data from the plants.

Since there are so few plants there is a problem with the fishery being controlled by fishing capacity rather than processing capacity. Last year there was too much dogfish landed in a short period of time. The result was fish going to the landfill.

How many dogfish tags are put out each year?

There is a tagging project off the coast of North Carolina run by Roger Rulifson. Program began about 5 years ago and averaged 2000 tags per year with about 3000 tags being applied in 2002.

Would 2000 fish tagged in Canadian waters be of use?

This would provide some information on movements of dogfish in Canadian waters and mixing with dogfish in US waters.

THE FISHERY IN THE US - MONITORING EFFORTS, REGULATIONS AND MANAGEMENT GOALS

Presenter: Hannah Goodale

It appears that the States didn't agree with the restrictive measures imposed by the Federal management plan. Do the US fishermen feel that dogfish are in trouble?

There is a perception that there is a problem with the management measures. The industry is seeing large numbers of dogfish and can't understand why there would be such restrictive management measures. Although the federal scientists agree that there is a reasonable overall dogfish abundance, however there is a reduction in the abundance of mature female dogfish.

Has there been an effort to limit the number of mature female fish caught by the fishery?

No. Some ideas were considered when the plan was proposed (such as a slot size limit), but it wasn't possible to come up with an effective way to implement such measures. The plan has relied on an overall quota reduction and a possession limit that discourages directed fishing.

Is it possible for scientists to go to the SARC meeting and dispute the advice of the federal scientists resulting in the actual quota going up.

Yes. The argument isn't over the actual advice as much as he methods used.

How do the processors react to most of the quota being landed in 2 months of the year?

It is not working well. In fact at least one of the processors went out of business.

Do fishermen have to submit logbooks?

Fishermen have to submit logbooks monthly. Processors have to submit weekly updates and monthly detailed reports.

THE FISHERY IN CANADA - MONITORING EFFORTS, REGULATIONS AND MANAGEMENT GOALS

Presenter: Jon Hanson

At recent meetings when dogfish is brought up there are comments made that Canadian quota cannot increase due to pressure from the US for Canadian

quotas to be reduced. Now that the US is doubling their quotas will Canadian fishery see a similar increase?

Canadian fisheries management has never said that the quotas were set based on US information. The Canadian quotas are set based on input from DFO Science.

It is hoped that there will be a call for new science proposals from all the community groups.

When the dogfish quotas for the current year are discussed this will be part of that discussion.

Is there an estimate of the amount of dogfish discarded?

Dogfish is a species that is permitted to be discarded and as a result there records are not kept.

Will there be annual assessments done on the Canadian portion of the stock?

There is an annual decision process but there is no intention to do an annual assessment. At present there is a plan in place to collect detailed science data for a period of 5 years after which a detailed stock assessment will be produced.

What is the quota overrun provision?

In the groundfish management plan there is a provision where groups can overrun their quota by 9.9t. This comes off the next year's quota on a tonne for tonne basis. Over 9.9t it comes off the future quota at a rate of 2 for 1.

If there is an increase in quota will it remain a <45 foot fixed gear quota?

There is no current intent to change that.

CONCLUSIONS

The Chair drew the meeting to a close, thanking the attendees for their participation, and noted that this meeting has been very worthwhile: it had highlighted the complexities of managing dogfish, indicated what is known and not known about them, and that clearly there is a lot of research to be done. She finally noted that this meeting is the start of a process for Canada and the USA to work more closely together in the management of spiny dogfish.

Appendix 1. List of Participants

Name	Organisation	Address	Phone	email
DFO Science				
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DFO Management				
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Industry – Management Boards				
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G. Thompson	Fundy North SWNB Fixed Gear		902-659-2885	Greg_fn@hotmail
E. Walters	Shelburne B		902-637-3276	sfifa@klis.com
G. Zinck	PAFFA		902-852-2764 902 823-1213	FAX: 902 852 3341
Industry-Processors				
M. LeBlanc	Ocean Pride		902-663-2731	
G. Prichard	Ocean Pride	Wedgeport, Yarmouth Co.	902-663-2731	
B. Blades	Sable Fish	Clarks Harbour, NS	902-745-2500	Sablefishpackers@ns.ca

Name	Organisation	Address	Phone	email
	Packers			
W. Blades	Sable Fish Packers	Barrington, NS	902-745-2500	Gylogic@hotmail.com
D. Cunningham	John's Cove Fisheries	Yarmouth, NS	902-742-8691	
NMFS Science				
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NMFS Management				
H. Goodale	NMFS		978 281-9101	Hannah.F.Goodale@noaa.gov
M. Gamble	Atlantic States Marine Fisheries Commission	1444 Eye Street, NW, 6th Floor Washington, DC 20005	202-289-6400	mgamble@asmfc.org
J. Armstrong	Mid-Atlantic Fishery Management Council	Room 2115, 300 South New St. Dover, DE 19904-6790	302.674.2331 ext.33	jarmstrong@mafmc.org
Other				
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Appendix 2: Background and Presentations

Background

Spiny dogfish is a species of shark that resides off the North East Atlantic coasts of both Canada and the USA. It has over the years been bycatch to fisheries in both countries and more recently subjected to targeted exploitation. Recently, concerns have been raised on the status of the resource and during Canada / US Steering Committee meetings, the US raised concerns on Canada's approach to dogfish management. It was agreed that a first step towards resolution of any issues raised would be a joint meeting, hosted by Canada, to exchange information and views on dogfish biology and its management in both countries.

Presentations

A series of 30-minute presentations (followed by 30 minutes of discussion) will be made on the topics outlined below. These will be based upon existing information on the resource, enhanced where possible with more recent observations. It is hoped that this exchange will assist US scientists in the preparation of their dogfish assessment, which is to be prepared in May 2003 and presented to the SARC in Woods Hole during 16 – 20 June 2003.

- Stock Structure, Distribution, and Seasonal Movements (P. Rago)
- Growth, Reproduction and Mortality (S. Campana)
- Trends in Abundance and Biomass in US and Canadian waters (P. Rago)
- Assessment Plans in the US and Canada (P. Rago & S. Campana) – this is expected to be no more than 15 minute discussion on the process
- The Fishery in the US, Monitoring Efforts, Regulations and Management Goals (H. Goodale)
- The Fishery in Canada, Monitoring Efforts, Regulations and Management Goals (J. Hansen)

Appendix 3. Compilation of the Presentations

STOCK STRUCTURE, DISTRIBUTION AND SEASONAL MOVEMENTS OF SPINY DOGFISH

by P. Rago and S. Campana

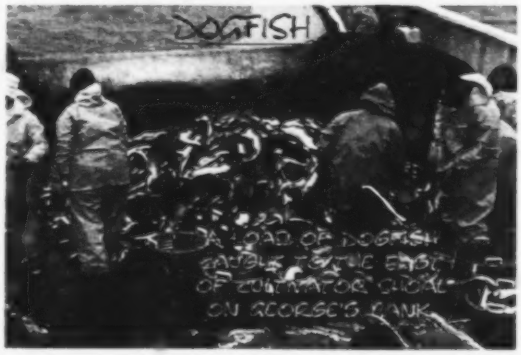
Stock Structure, Distribution and Seasonal Movements of Spiny Dogfish

Canada/US Information Session
Halifax, NS
April 4, 2003

Paul Rago and Steve Campana
National Marine Fisheries Service, Woods Hole, MA
Department of Fisheries and Oceans, BIO

NOAA Fisheries

Fisheries and Oceans Canada | Pêches et Océans Canada



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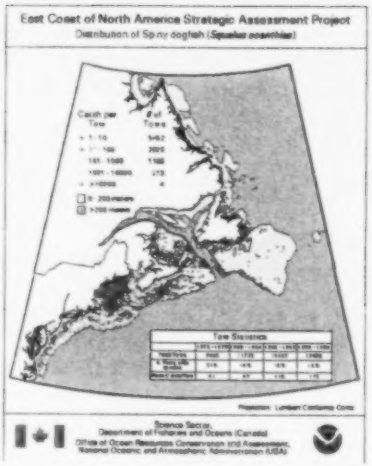
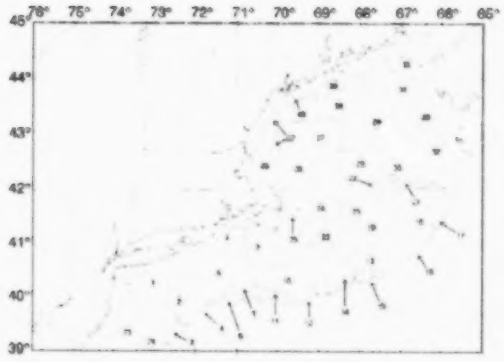
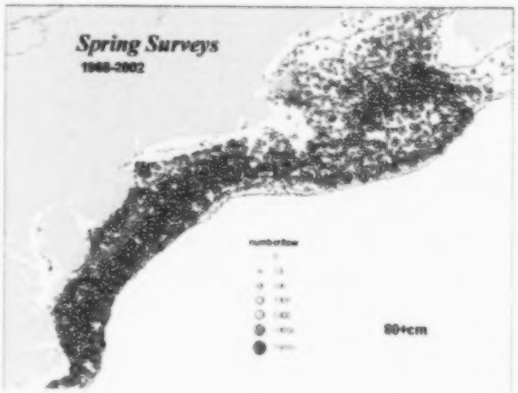
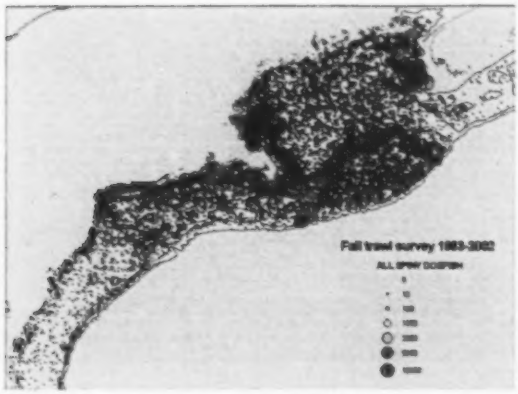
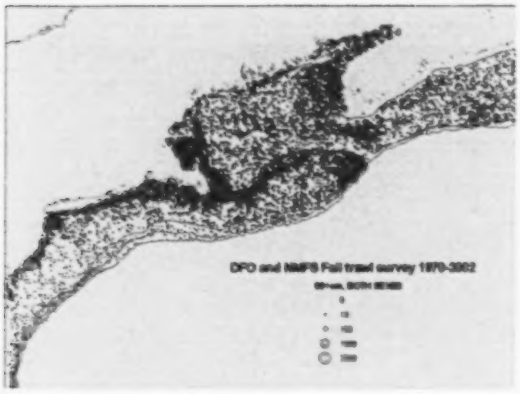

East Coast of North America Strategic Assessment Project
Distribution of Spiny dogfish (Squalus acanthias)
Science Sector
Department of Fisheries and Oceans (Canada)
Office of Ocean Resources Conservation and Assessment
National Oceanic and Atmospheric Administration (USA)

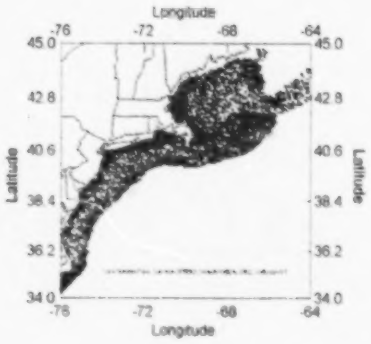





Fall trawl survey 1983-2002

DFO trawl survey 1970-2002


DFO and NMFS Fall trawl survey 1970-2002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-72
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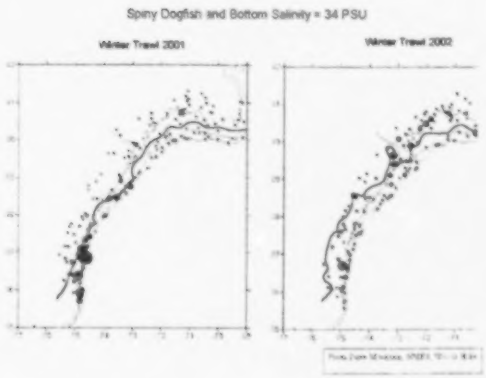
40.6
38.4
36.2
34.0
Latitude
Longitude

WINTER 1982-2002


Spiny Dogfish and Bottom Salinity = 34 PSU
Winter Trawl 2001
Winter Trawl 2002

STOCK STRUCTURE, DISTRIBUTION AND SEASONAL MOVEMENTS OF SPINY DOGFISH

by P. Rago and S. Campana

Stock Structure, Distribution and Seasonal Movements of Spiny Dogfish

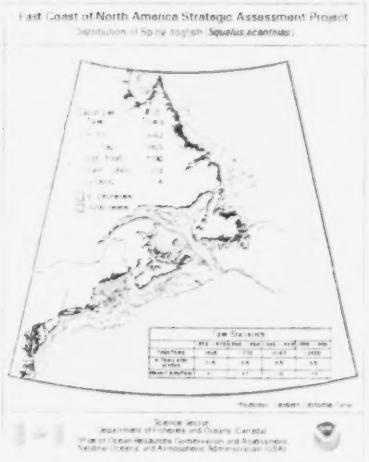
Canada/U.S. Information Session
Halifax, NS
April 4, 2003

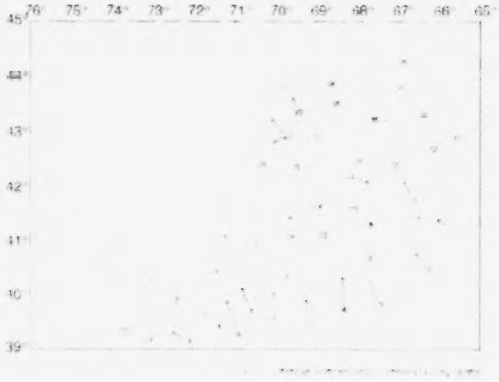
Paul Rago and Steve Campana
National Marine Fisheries Service, Woods Hole, MA
Department of Fisheries and Oceans, BIO

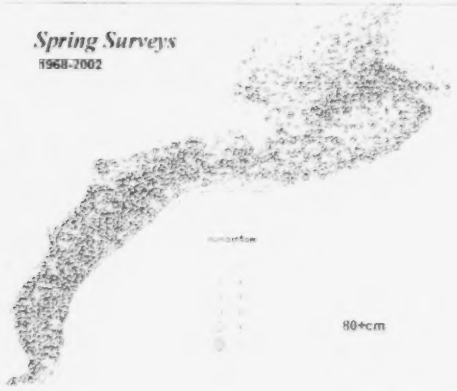
NOAA Fisheries

Fisheries and Oceans Canada / Pêches et Océans Canada

Distribution

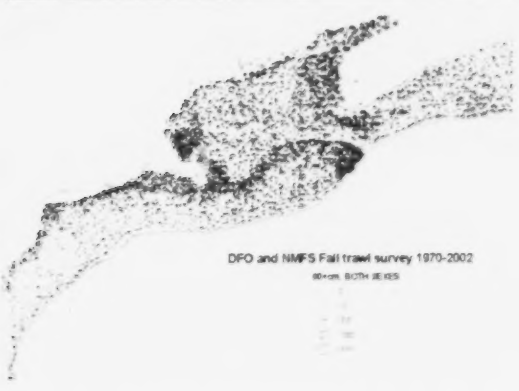


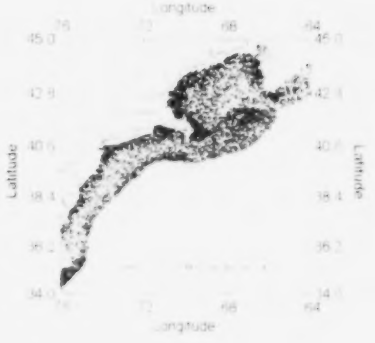




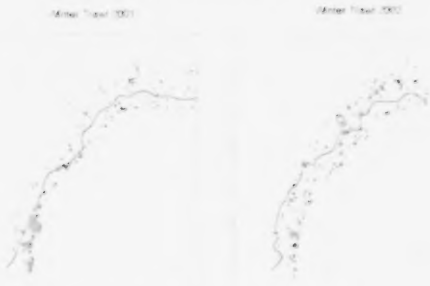
Fall trawl survey 1983-2002

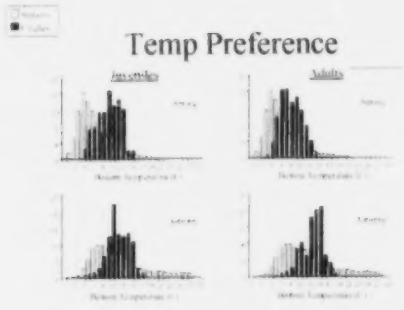
DFO trawl survey 1970-2002

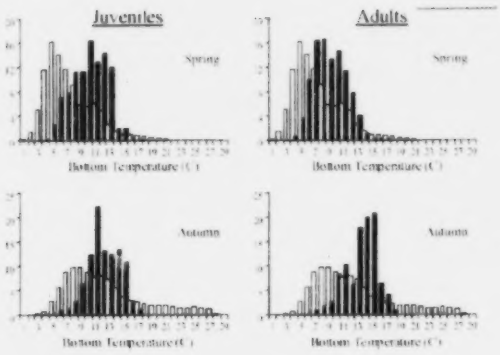

DFO and NMFS Fall trawl survey 1970-2002

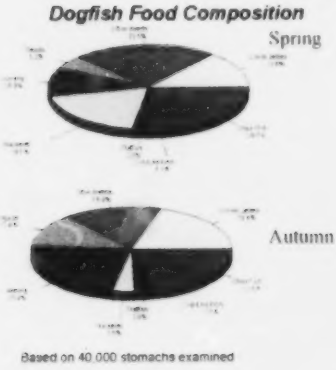

Longitude
Latitude
Longitude

WINTER 1992-2002
10+cm. ALL

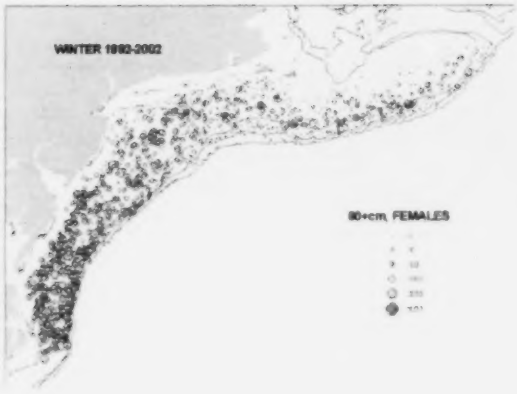




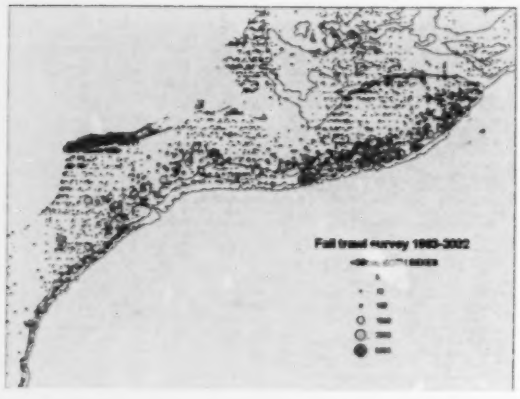


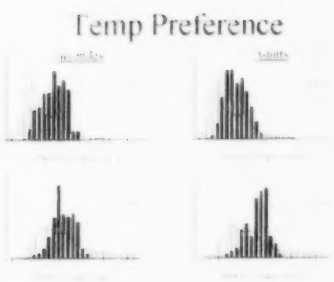


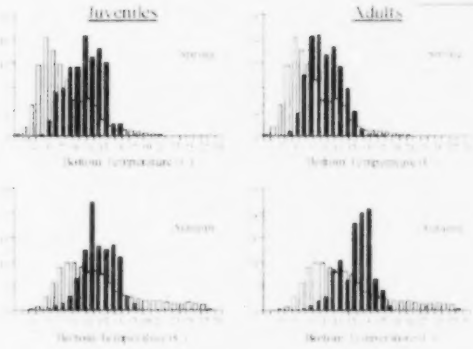
Seasonal Changes in Adult Dogfish (80+ cm)

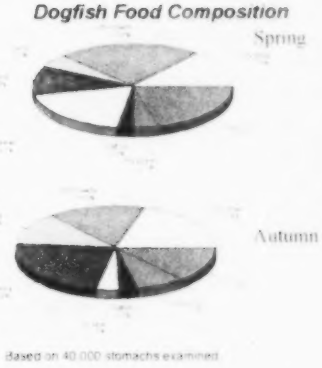


Seasonal Changes in Distribution of Dogfish Pups (<36 cm)









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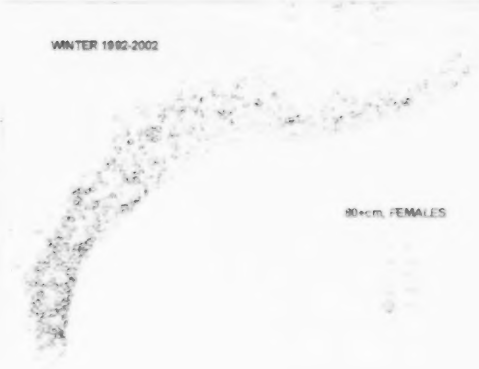
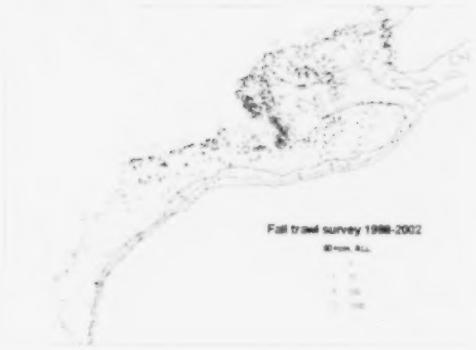
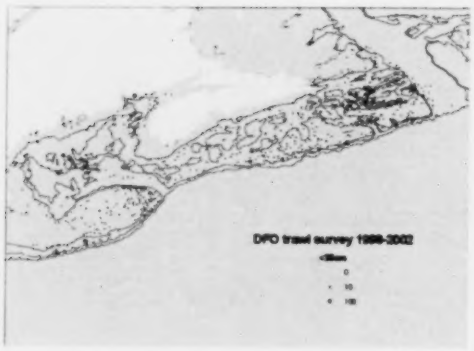
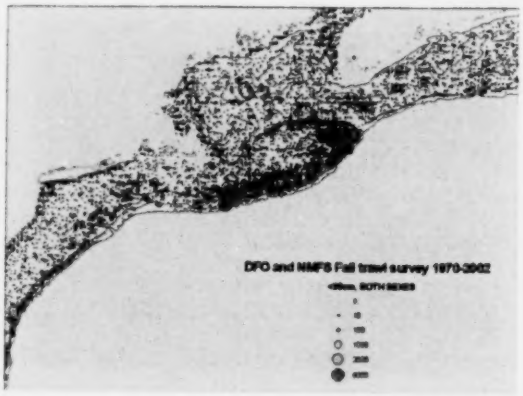


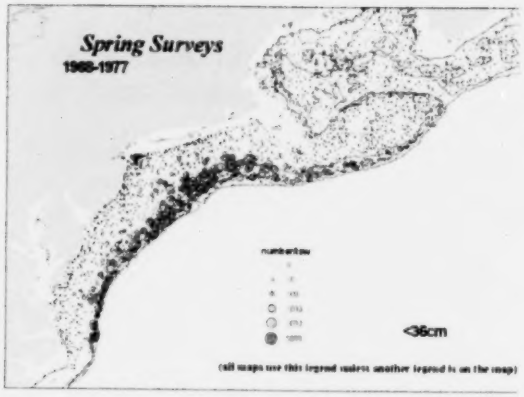


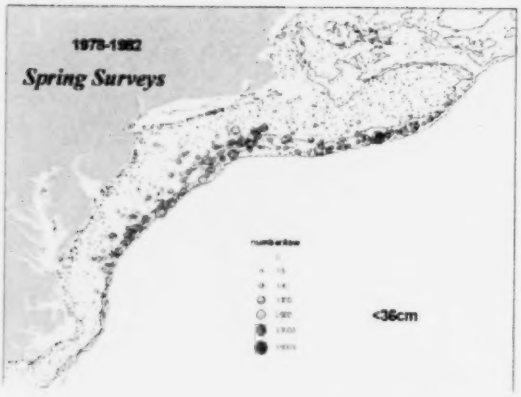
Seasonal Changes in Distribution of Dogfish Pups (<36 cm)

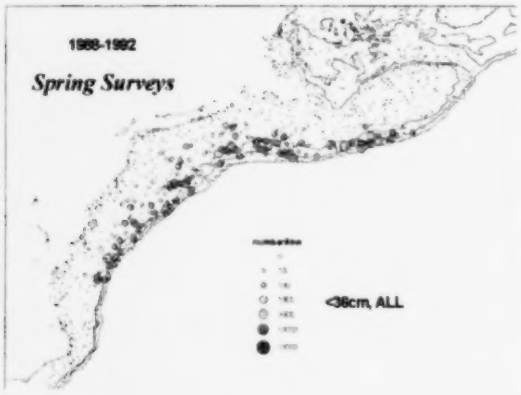


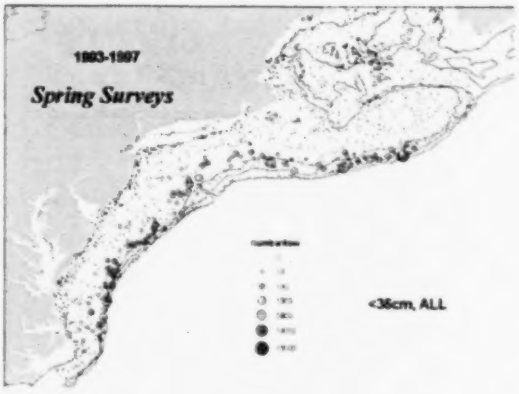


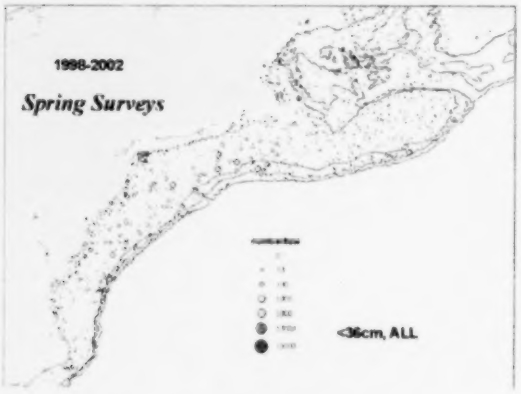
Temporal Changes in
Distribution of Dogfish Pups
(<36 cm)



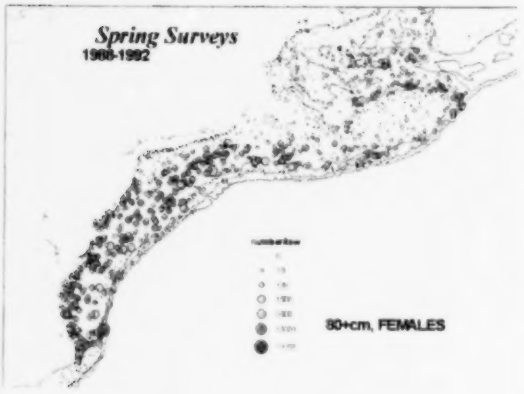


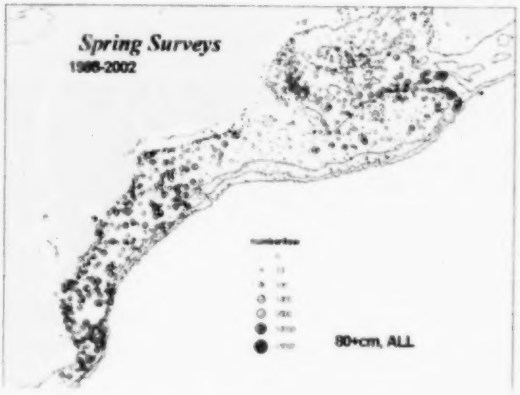


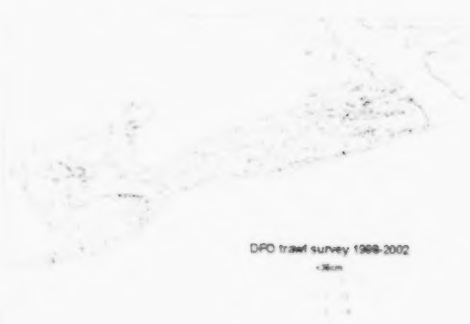


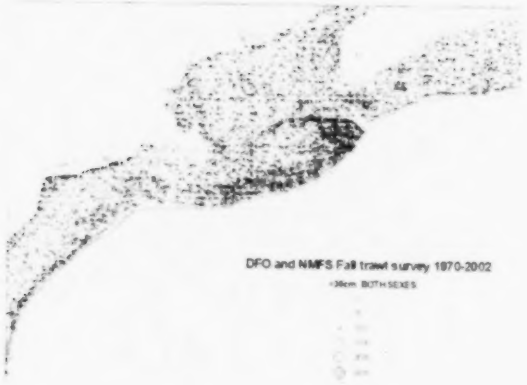


Temporal Changes in Abundance of 80+cm females in Spring Survey

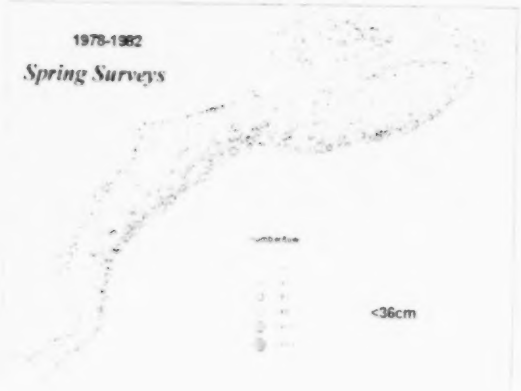


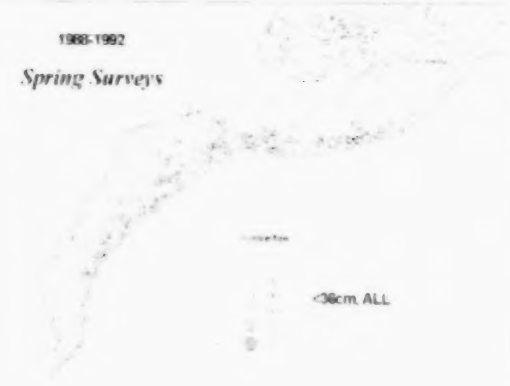


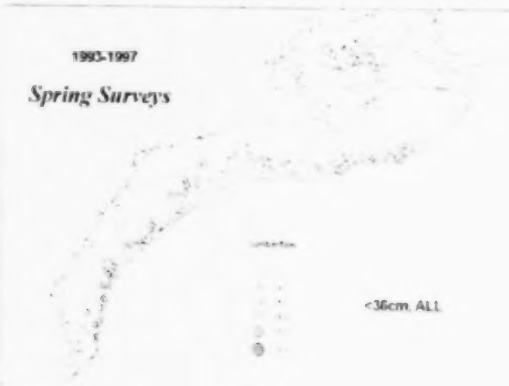




Temporal Changes in Distribution of Dogfish Pups (<36 cm)







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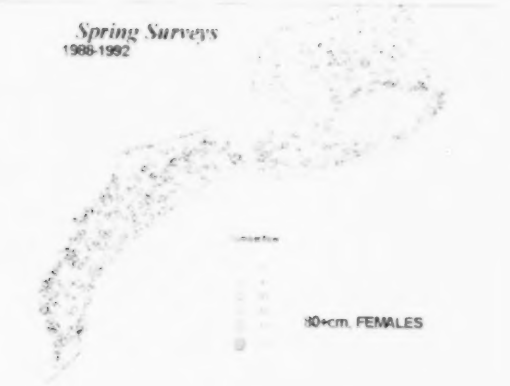


END

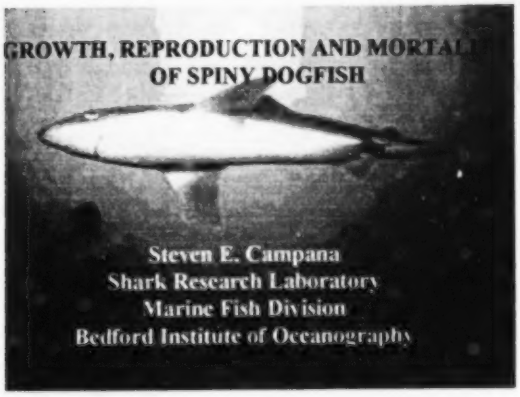
Table 1 Effect of towing speed and door width on estimated area swept per tow. "True" values are based on limited Scanmar estimates of trawl performance revised estimates of doppler based vessel speed and a conservative estimate of 3 additional minutes of fishing time during payout and haulback of trawl.

	Nominal	TRUE	Ratio
Tow Speed (knots)	3.5	3.8	1.0857
Tow Duration (min)	30	33	1.1000
Tow Distance (nautmi)	1.75	2.09	1.1943
Tow Distance (ft)	10500	12540	1.1943
Net Width (ft)	35.93	35.93	1.0000
Door Width (ft)	68.6	68.6	1.0000
Area Swept (ft^2) (doors)	720300	860244	1.1943
Area Swept (ft^2) (net)	377300	450684	1.1943
Total Area (GOM) n mi^2	64207	64207	1.0000
Conversion 1 n mi^2 =6076 ft^2	36917776		

Max Raising Factor
2.28

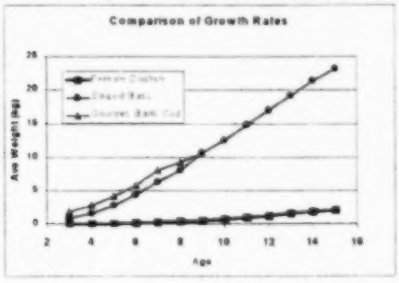
860244
377300

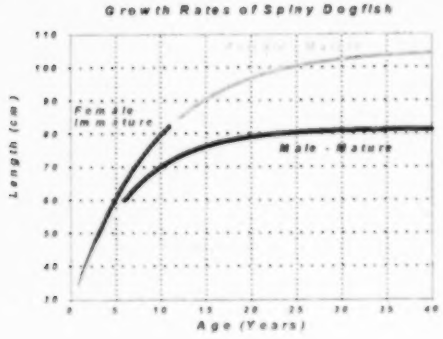
GROWTH, REPRODUCTION AND MORTALITY OF SPINY DOGFISH
by S. Campana



Age and Growth

Like all sharks, dogfish grow very slowly and are very long-lived





Could dogfish be even slower-growing than we think?

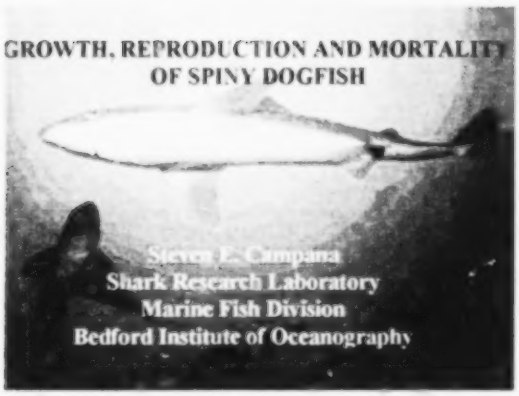
- Earlier work in the NW Atlantic suggests a lifespan of 25-40 years
- Ages as old as 70 years have been seen in dogfish of British Columbia, with half the growth rate of what we've assumed here.

Are the East Coast dogfish really faster-growing than those on the West Coast?

Spiny Dogfish
Squalus acanthias

Spine showing annuli

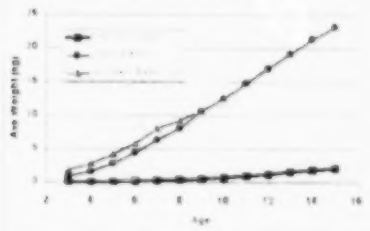
GROWTH, REPRODUCTION AND MORTALITY OF SPINY DOGFISH
by S. Campana

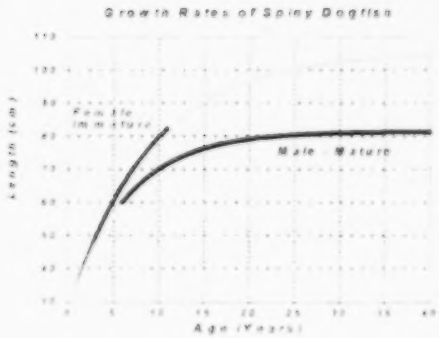

GROWTH, REPRODUCTION AND MORTALITY OF SPINY DOGFISH
Steven E. Campana
Shark Research Laboratory
Marine Fish Division
Bedford Institute of Oceanography

Age and Growth

Like all sharks, dogfish grow very slowly and are very long-lived

Comparison of Growth Rate





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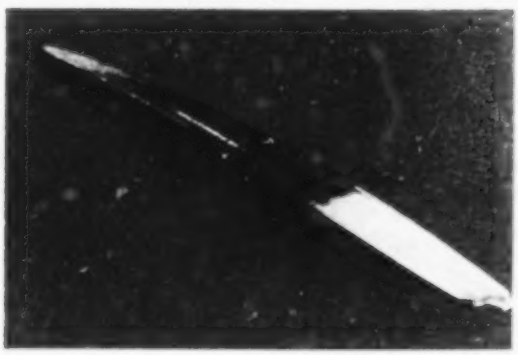
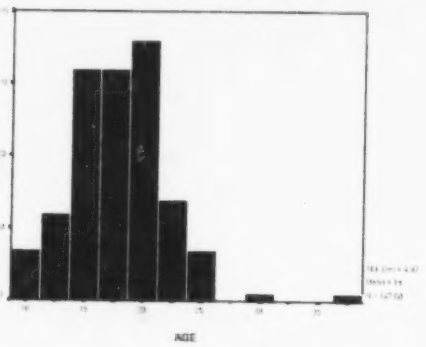
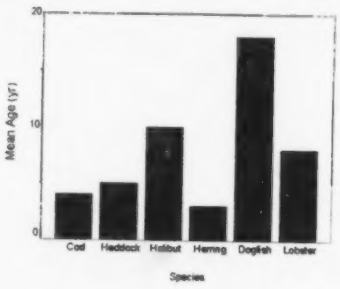


Age of Dogfish in Canadian Catch

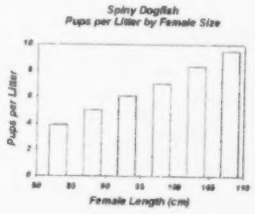


Average Age in Catch

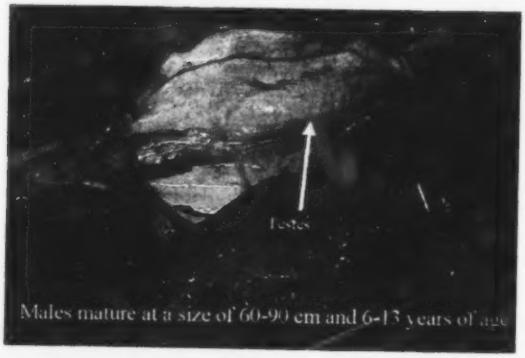


Reproduction

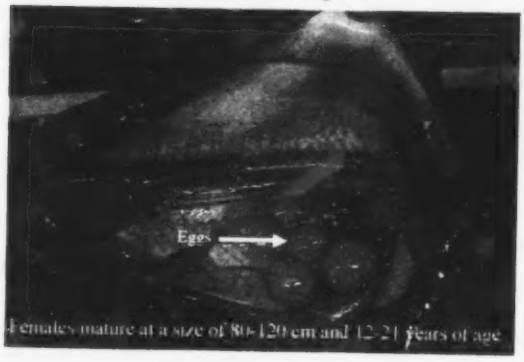
- Gestation Period : 24 Months
- Average litter of 6 pups (range of 2-12)
- Pups born at ~30 cm



Mature male dogfish

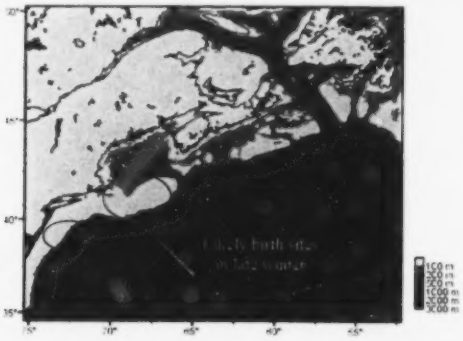


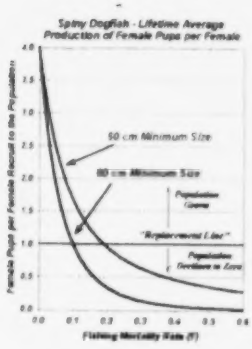
Mature female dogfish



Young embryo
(still inside candle)

Developed embryo
with yolk sac attached



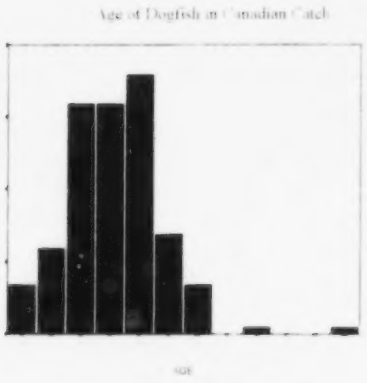

Spiny Dogfish - Lifetime Average Production of Female Pups per Female
50 cm Minimum Size
80 cm Minimum Size
Population Grows
"Replacement Line"
Population Declines to Zero
Female Pups per Female Recruit to the Population
Fishing Mortality Rate (F)

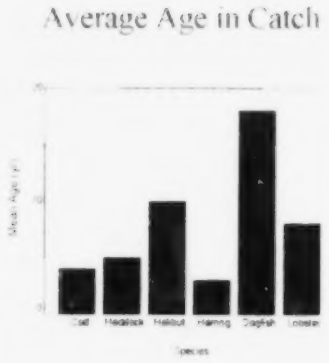
Sources of Mortality

The natural mortality rate is very low, about 1/4 - 1/2 that of a cod

Fishing Mortality

- Fishing mortality comes from both landed catch and discards
- If fishing mortality is much bigger than natural mortality, the stock collapses
- What the biologists will try to do next is to calculate fishing mortality



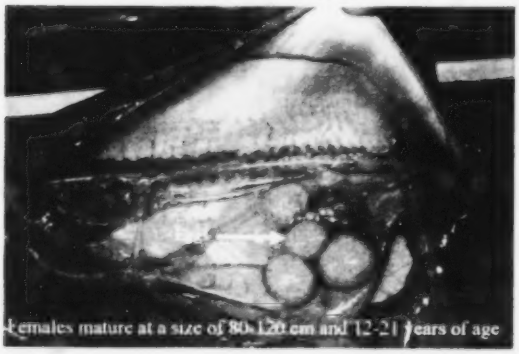


Reproduction

- Gestation Period 24 Months
- Average litter of 6 pups (range of 2-12)
- Pups born at ~30 cm

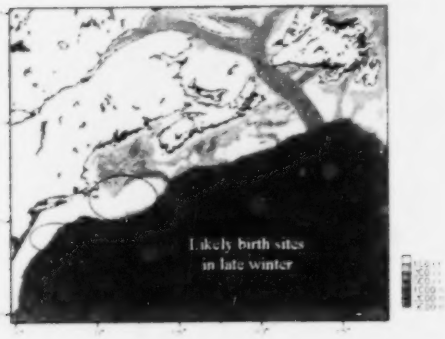
Mature male dogfish

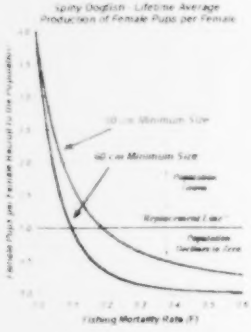
Mature female dogfish



Young embryo (still inside candle)

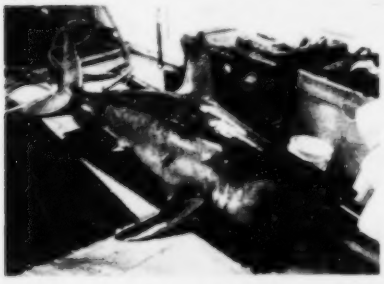
Developed embryo with yolk sac attached





Sources of Mortality

The natural mortality rate is very low, about 1/4 - 1/3 that of a cod



Fishing Mortality

- Fishing mortality comes from both landed catch and discards
- If fishing mortality is much bigger than natural mortality, the stock collapses
- What the biologists will try to do next is to calculate fishing mortality

TRENDS IN ABUNDANCE AND BIOMASS OF SPINY DOGFISH IN US AND CANADIAN WATERS

by P. Rago and S. Campana

Trends in Abundance and Biomass of Spiny Dogfish in US and Canadian Waters

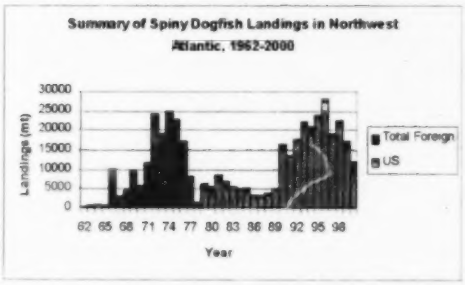
Canada/US Information Session
Halifax, NS
April 4, 2003

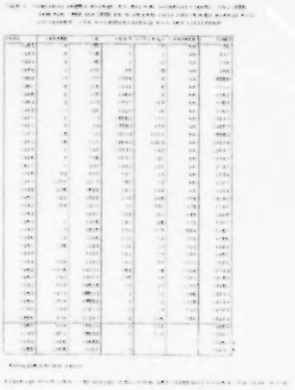
Paul Rago and Steve Campana
National Marine Fisheries Service, Woods Hole, MA
Department of Fisheries and Oceans, BIO

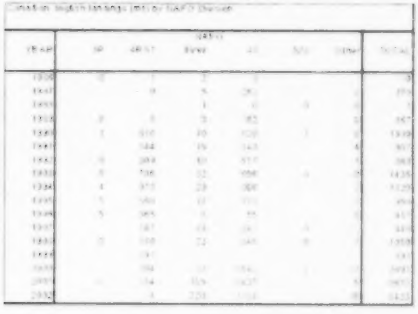
NOAA Fisheries

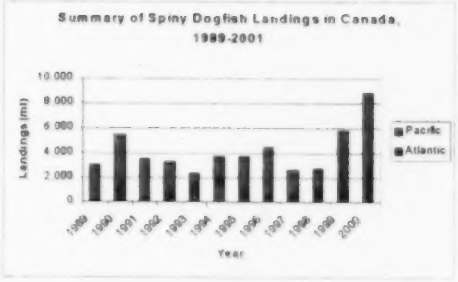
Fisheries and Oceans Canada / Pêches et Océans Canada

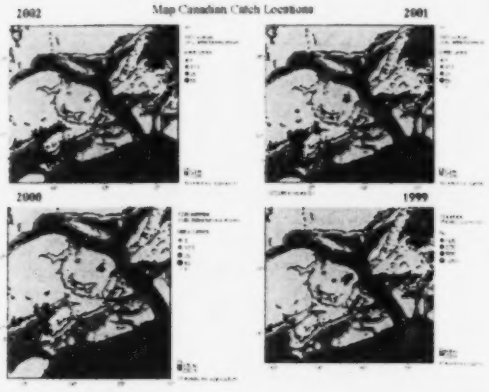
Commercial Landings

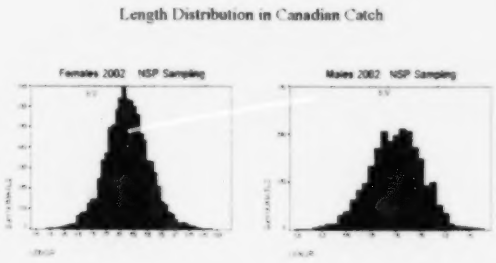


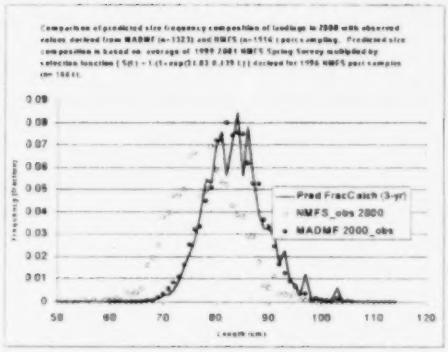






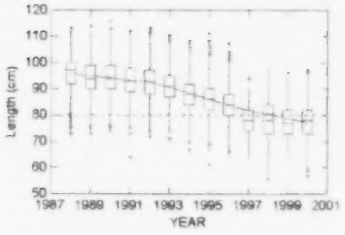




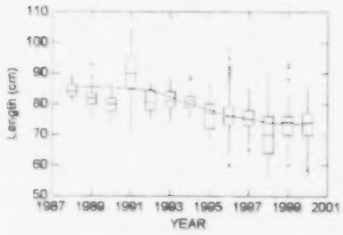


Size Composition of Commercial Landings

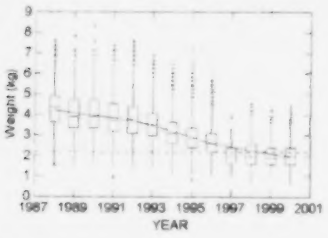
Comm. Landings Length Samples: Female Dogfish



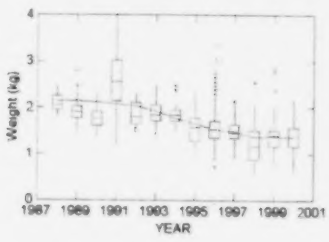
Comm. Landings Length Samples: Male Dogfish



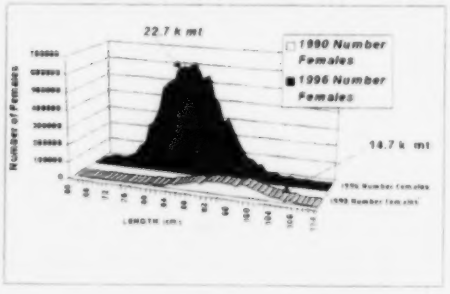
Comm. Landings Samples: Est Weight: Female Dogfish



Comm. Landings Samples: Est Weight: Male Dogfish

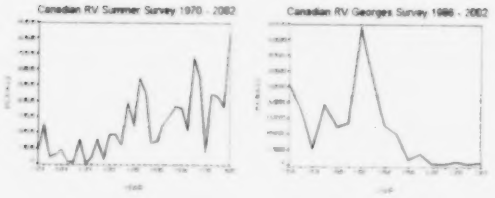


Size Composition of Landings: 1990 vs 1996 Females

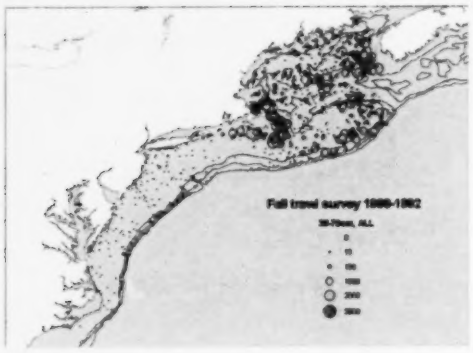


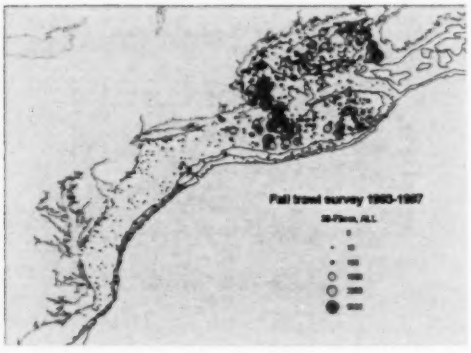
Trends in Survey Abundance

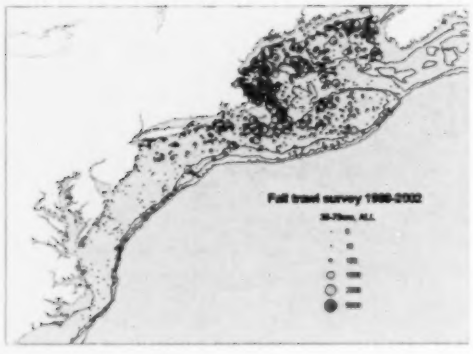
Biomass in Canadian RV Surveys



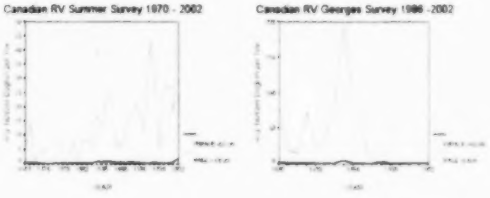
Biomass in Canadian RV Surveys - By Sex



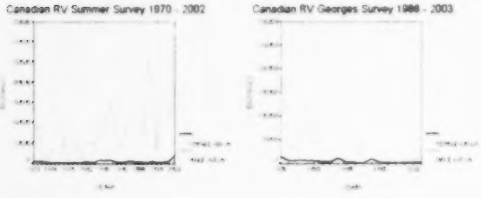


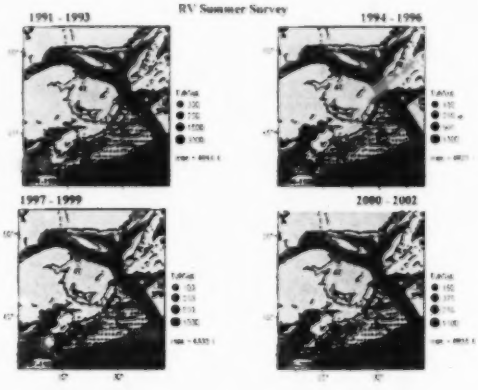


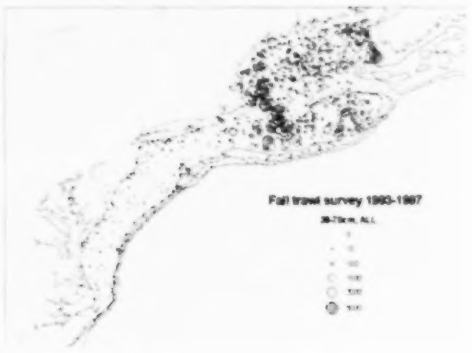
Abundance in Canadian RV Surveys - Mature Dogfish By Sex



Biomass in Canadian RV Surveys - Mature Dogfish By Sex

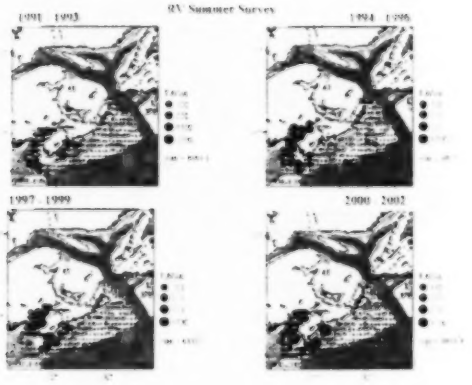




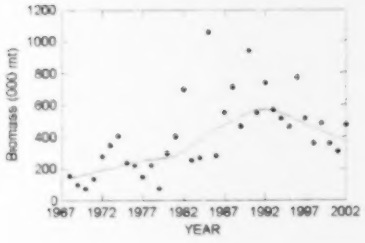


Abundance in Canadian RV Surveys - Mature Dogfish By Sex

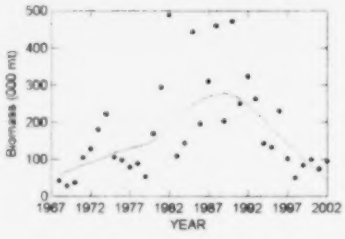
Biomass in Canadian RV Surveys - Mature Dogfish By Sex



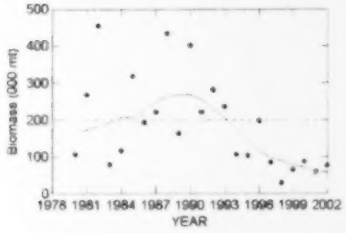
Swept Area Biomass: All Sizes



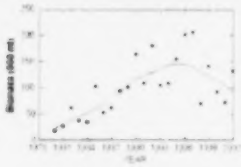
Swept Area Biomass: All>=80 cm



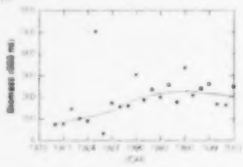
Swept Area Biomass: Females>=80 cm



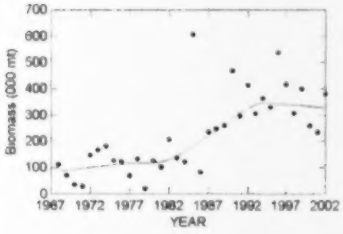
Swept Area Biomass: Females 36-79cm



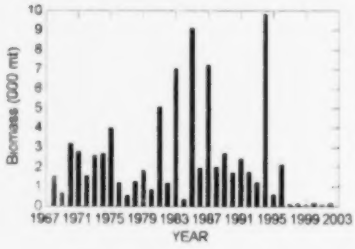
Swept Area Biomass: Males 36-79cm



Swept Area Biomass: All 36-79cm



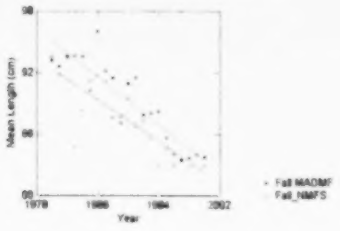
Swept Area Biomass: All <=35cm



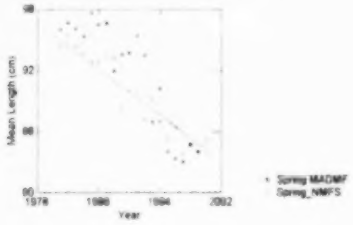
Survey Trends:

Average Length of Mature Female Dogfish (>80cm)

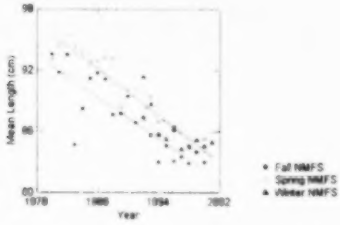
Female Dogfish>80cm, MADMF and NMFS Fall Surveys



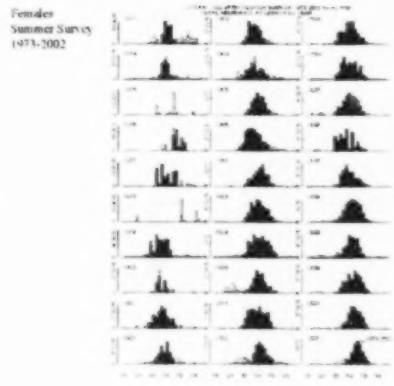
Female Dogfish>80cm, MADMF and NMFS Spring Surveys



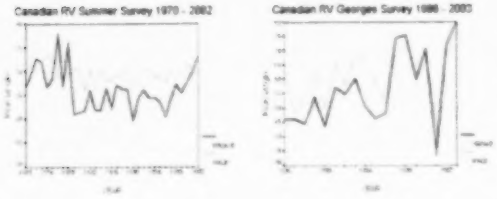
Female Dogfish>80cm, NMFS Spring and Fall Surveys

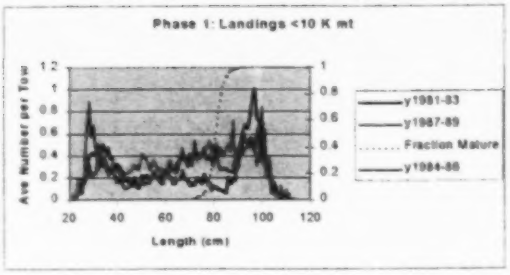


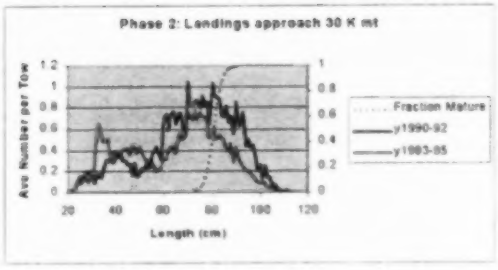
Changes in Size composition over time.

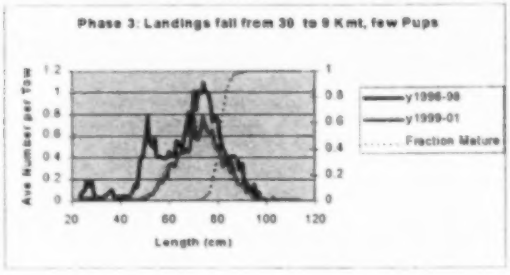


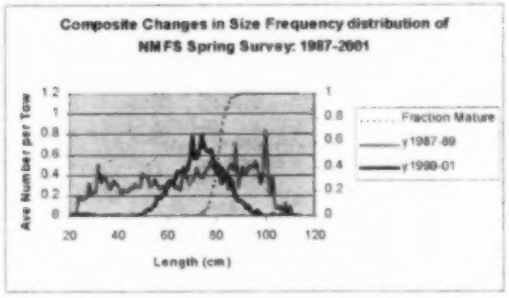
Mean Length in Canadian RV Surveys - By Sex





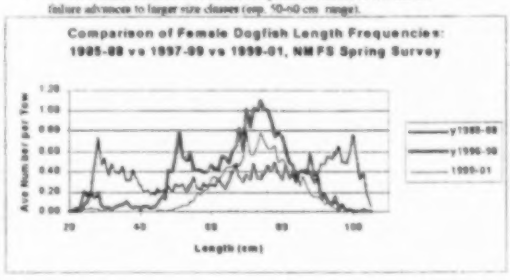


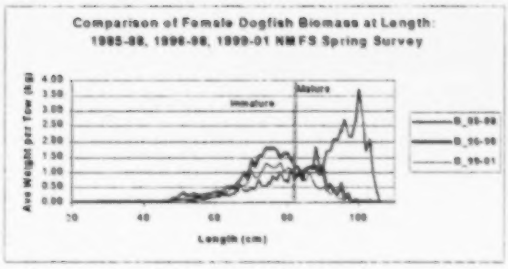




Composite Summary of recent changes in spiny dogfish size composition:

- '85-88 Near equilibrium conditions with high abundance of mature females and strong recruitment.
- '96-98 Large females removed by fishery, recruitment suppressed, but large pool of pre-reproductive females (survivors of reproduction ~10 years earlier)
- '99-01 Continued reduction of mature component, evidence of recruitment failure advances to larger size classes (esp. 50-60 cm range).



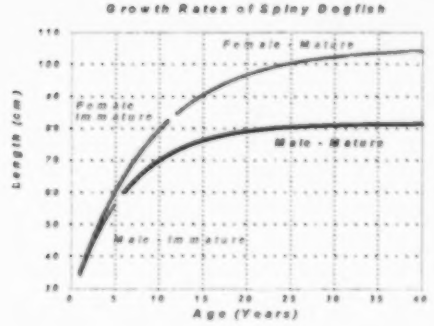


Estimates of Fishing Mortality based on Mean Length: Beverton and Holt Method

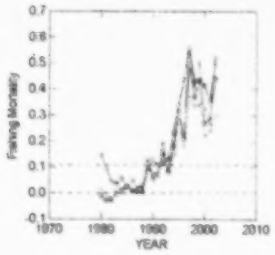
$$Z = \frac{K(L_{inf} - \bar{L})}{\bar{L} - L_{CRIT}}$$

$$F = Z - M$$

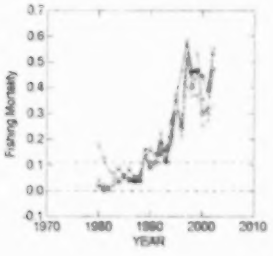
- Estimator
- Considered wide range of size at entry to fishery: 70-90 cm
- Considered two alternative estimates of natural mortality: M=0.092, 0.061



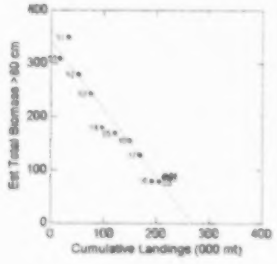
Range of Fishing Mortality Rates for Varying Lcrit & M=0.092



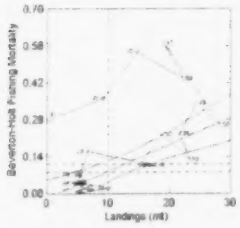
Range of Fishing Mortality Rates for Varying Lcrit & M=0.061



Change in Estimated Abundance of Mature Dogfish

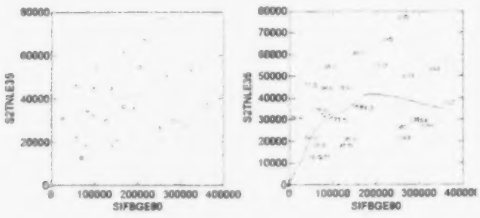


B-H Fishing Mortality vs Landings: M=0.081 Lcnt=80



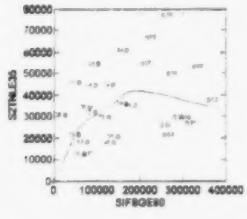
SR Curve (SSB 2-pt smooth vs Recruits)

2 pt ave Recruits vs 2 pt smooth imputed b



SR Curve (SSB 2-pt smooth vs Recruits– OVERLAY)

2 pt ave Recruits vs 2 pt smooth imputed biomass



- ***If the estimates were adjusted for the hypothetical increase in the trawl footprint to 0.012 nm², as described at the March 6, 2009 meeting of the DTC, the current adult female biomass would be 59,000 mt and the reference point would become 167,000.***

Deterministic Projection Model

$$N_{L,t+1} = [S][P]N_{L,t} + N^{T}_{L,t} Pup \; N^{o}_{L,R}$$

where

$N_{L,t}$ = Vector of pop abundance at Length

$[S]$ = Diag matrix of length specific survival rates where S(L,L)=exp(-(F_L+M))

$[P]$ = Projection matrix (0,1) elements which advances pop From length j in year t to length k in year t+1

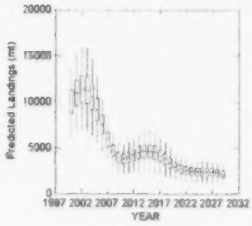
$[Pup]$ = Vector of # pups per female of length class j

$N^{o}_{L,R}$ =Vector of proportions of new recruits at lengths ~36cm

Stochastic Methodology

- Rescale Length Frequency Distribution based on variation in mean abundance (composite for 1999-2001)
- Integrate over 95%-ile of abundance, assuming that MEAN abundance in Normally distributed.
- Consider implications of abundance variation only.
- Compare management alternatives
  - High F in 2000 (~0.28 continues)
  - Zero F from 2002 onward
  - Management Plan F (~0.03) until rebuild
  - Constant Quota of 8 M lb per year

Yield under Status Quo F=0.28



Mass balance vs Discard Estimation

- Mass Balance
  - The predicted catch can be obtained by applying the SH estimates of F and the size specific selectivity function s(l) to the swept area estimates by l.
  - residual difference between predicted catch and observed catch is not simply an indirect estimate of discards
- Discrepancy between observed and predicted catch could be due to
  - overestimation of F,
  - underestimation of landings
  - overestimation of stock biomass
- Considerations:
  - increased survey footprint,
  - alternative estimators of discards,
  - improved estimation of fishing mortality by incorporating size selectivity

Uncertainties, Caveats, Loopholes

- Ability to control F
- Implied Bycatch vs Mass Balance: Rescaling Parameters: Females—0.55, Males=0.14
- Relationship between Landings and Catch
- Pup Survival Rate – appears to be declining or fecundity is overestimated
- Variations in other parameters: Growth, Natural mortality, pup production

ASSESSMENT PLANS FOR SPINY DOGFISH IN US AND CANADA
by P. Rago and S. Campana

Assessment Plans for Spiny Dogfish in US and Canada: the next three months...

Canada/US Information Session
Halifax, NS
April 4, 2003

Paul Rago and Steve Campana
National Marine Fisheries Service, Woods Hole, MA
Department of Fisheries and Oceans, BIO

NOAA Fisheries

Fisheries and Oceans Canada | Pêches et Océans Canada

Assessment Schedule

- 37th Northeast Regional Stock Assessment Workshop, Stock Assessment Review Committee, June 16-20, TBD
- Joint SARC Southern Demersal Subcommittee and ASMFC Technical Committee, May 12-16, Woods Hole
- ASMFC Technical Committee Review of SARC product, Late May

Terms of Reference

- Characterize commercial and recreational catch for entire stock and identify methods for improving the accuracy of discards and discard mortality estimates.
- Estimate current and historic fishing mortality estimates, SSB and their uncertainty.
- Update or re-estimate biological reference points as appropriate.
- Estimate yield based on stock status and target mortality rate (F=0.08) for fishing year 2004 (May 2004-April 2005)
- Provide short term projections (2-3 yr) of stock status under a variety of TAC/F strategies.
- Evaluate existing and alternative rebuilding schedules based on current/projected stock status.
- Provide estimates of juvenile recruitment and pupping rates and evaluate uncertainty.
- Characterize level of discards, bycatch rates, discard mortality rates and length and sex data for spiny dogfish (per trip, per net, etc.) in directed and bycatch fisheries and how changes in regulations and fishing practices may have affected these rates.

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Biological sampling of landings
Multiple fisheries
- trawl
- gillnet
- hook and line
- Recreational

At Sea sampling
Special Studies for Discarding and Survival

Terms of Reference

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Abundance Estimation

Improve understanding of survey variability
Swept Area estimators
Smoothing Methods
Environmental associations

Mortality

Length based estimators
Change in ratio methods
Catch/Biomass
Other model based approaches

Terms of Reference

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Life History Model to Estimate Target F

Effects of smaller size at entry
Reduced survival of pups
Longevity

Stock-Recruitment relationship to estimate biomass target

Possible alternative measures, ecosystem based?

Terms of Reference

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Stochastic length based projection model

Uncertainty in initial estimates
Evaluate range of recovery strategies
Probability of Recovery

Terms of Reference

- Characterize commercial and recreational catch for entire stock and identify methods for improving the accuracy of discards and discard mortality estimates
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Compare with life-history predictions
Summarize information from reproductive studies
Lower Abundance: alternative hypotheses

Smaller mothers ==>smaller pups
small pups==>lower survival
Higher discards==>greater capture stress
Increased predator abundance offshore

Terms of Reference

- Characterize commercial and recreational catch for entire stock and identify methods for improving the accuracy of discards and discard mortality estimates
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- **Characterize level of discards, bycatch rates, discard mortality rates, and length and sex data for spiny dogfish (per trip, per net, etc.) in directed and bycatch fisheries and how changes in regulations and fishing practices may have affected these rates.**

Do everything.
Fix xerox machine before meeting.

To Do List

- Coordinate data and document exchanges among US and Canadian investigators
- Summarize results of ongoing relevant studies.e.g.
  - Discard survival
  - Reproductive biology
  - Tagging studies
  - State monitoring programs
- Facilitate/Initiate special studies for biological information

THE FISHERY IN THE US – MONITORING EFFORTS, REGULATIONS AND MANAGEMENT GOALS

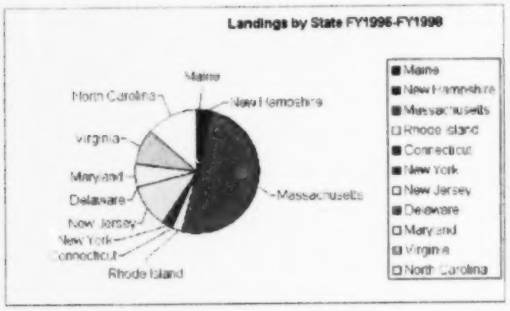
By H. Goodale

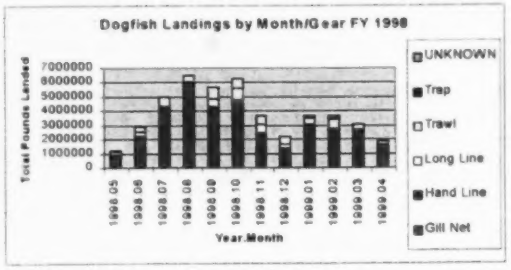
OVERVIEW OF U.S. SPINY DOGFISH FISHERY

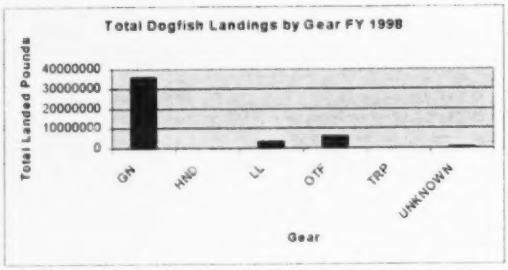
Canada/US Information Session
April 4, 2003
Halifax, Nova Scotia

Fishery Before Management

- Most landings were in Massachusetts, New Jersey, North Carolina, Virginia, Maryland
- Adult females were targeted due to market preference for larger fish
- Landings increased greatly in 1990's, peaking at 59 million lb in 1996
- Gillnet was primary gear in 1990's







Establishing the FMP

- Stock was declared overfished April 1998: triggered legal requirement to develop a fishery management plan (FMP)
- Mid-Atlantic and New England Fishery Management Councils have joint management responsibility; submitted FMP to NMFS May 1999
- FMP was reviewed and partially approved: measures effective May 2000

Management Program

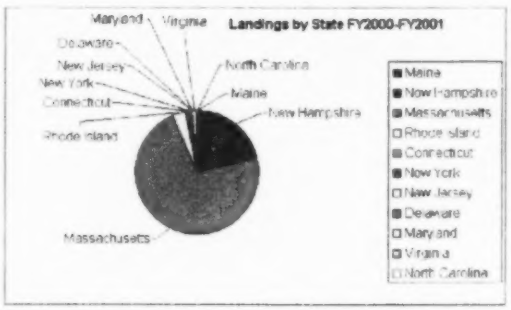
- Target fishing mortality rates are specified to end overfishing and rebuild the stock (F=0.03 through April 2004, then F=0.08)
- Annual measures are set to achieve F target: commercial quota, possession limits
- Fishing year starts May 1; two quota periods: May-Oct (58%); Nov-April (42%)

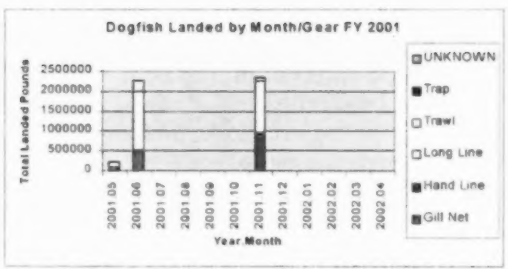
Management Measures

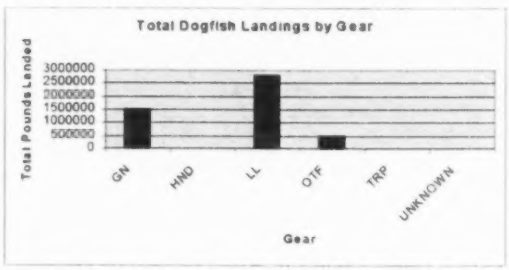
- Since implementation in May 2000, Federal management measures have been stable:
- Commercial quota of 4 million lb
- Possession limits of 600 lb/trip May-Oct and 300 lb/trip Nov-April
- Mandatory vessel, dealer, operator permits; mandatory vessel and dealer reports

Current Fishery

- Changes are noted in seasonal landings, state of landing, and gear types used
- Federal FMP does not regulate fishing that occurs only within state waters (0-3 miles)
- State management has not been consistent with Federal measures







Interstate Management

- State measures are enacted through Atlantic States Marine Fisheries Commission
- Emergency action August 2000 required states to close during Federal closures: directed fishing continued until closure
- Interstate FMP approved November 2002 for implementation May 2003
- State/federal measures differ in some ways

Interstate Management

- Same F target as FMP; same fishing year with commercial quota allocated to same two periods; **however**
- Annual quota on May 1 2003 will be 8.8 million lb with possession limits of up to 7,000 lb/trip; new regional allocations
- Biomedical supply harvest of 1,000 spiny dogfish authorized by an exemption permit

Interstate Quota

2003 - 2004 INTERSTATE COMMERCIAL SPINY DOGFISH QUOTA 8.8 MILLION POUNDS		
Fishing Year	Period I May 1 - October 30	Period II November 1 - April 30
Seasonal Allocation	57.9%	42.1%
ME, NH, MA	57.9% or 5,095,200 pounds	
RI South	42.1% or 3,704,800 pounds	

Amendment 1 will consider:

- Target biomass and age structure
- Rebuilding schedule
- Quota allocations including research quotas
- Whether or not to limit entry to fishery
- Discard issues
- Size limits
- Transboundary management with Canada

THE FISHERY IN CANADA - MONITORING EFFORTS, REGULATIONS AND MANAGEMENT GOALS

By J. Hanson

CANADA / USA Information Session on Dogfish

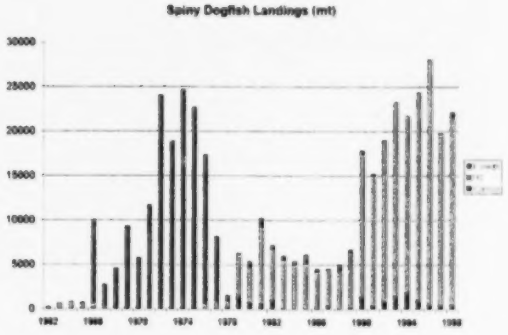
CDN Management Measures
4 April 2003
BIO Dartmouth NS

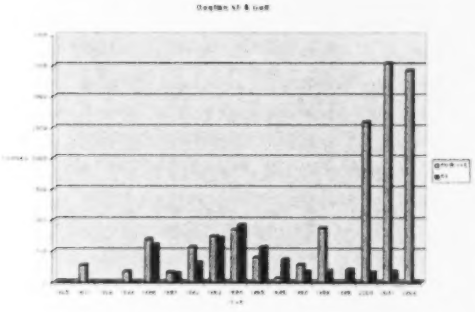
Early Years

- Dogfish was considered a nuisance species and of little value.
- Seen as serious pest that damaged fishing gear and as recent as mid 1980s was to be targeted for eradication.
- Some reports cited damage to gear and lost fishing opportunities in the $ millions.

DOGFISH

- Dogfish is defined by regulation as a groundfish species.
- Fished primarily with groundfish gear and groundfish caught as bycatch
- Fishing is only permitted by those holding valid groundfish licences.
- Limited entry nature of groundfish licences has prevented new or increased effort.



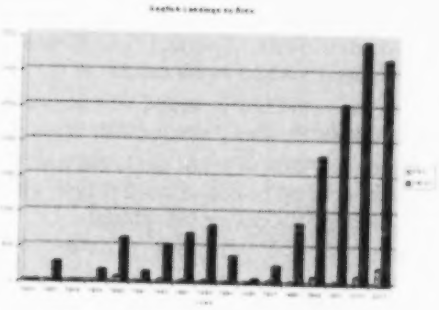


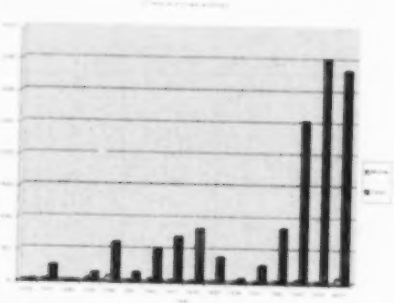
DOGFISH

- Early 1990's new entrants were requesting dogfish licences as few groundfish licence holders would fish for low priced dogfish.
- Prior to 2001 few restrictions for fixed gear with exception of requiring a groundfish licence.
- Handline main effort in Yarmouth area.

MOBILE GEAR

- Past interest in fishing for dogfish
- Various trials but bruising a concern
- Groundfish mesh size problematic due to meshing.
- Small mesh was not permitted
- Mobile gear landings limited to bycatch up to a maximum of 25t





Increased Interest

- Increased demand from US buyers fueled increased effort by end of 1990s.
- Landings began increasing slowly in 1999 and increased to 2500 t in 2000.
- Landings previously not above 1500 t but not all may have been recorded.
- Other species licence holders lobbied to keep dogfish (pelagic nets).

Quota Limitation

- Quota cap of 2500 t implemented mid July for fixed gear in 2001.
- Limit was not supported by industry citing high abundance and good markets.
- Quota overrun with final landings at 3,500 t.

Quota Continued

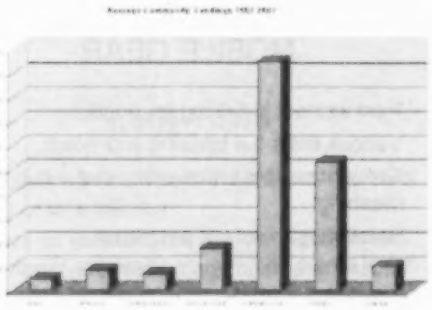
- Quota cap of 2500t implemented first time by Minister in 2002 with Community quotas.
- Again not supported by industry who disagreed with stock status citing increased abundance.
- Not an increase in effort but a change from discarding to landing.
- No support for a single stock as dogfish present all year.

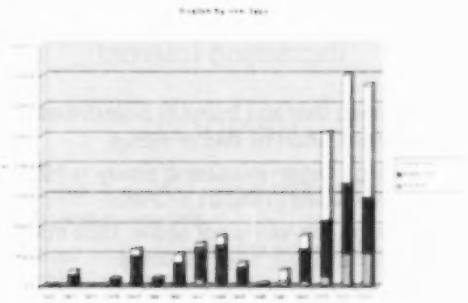
Community Quota

Interim community quota in 2001 was based on previous two years catch.

Formula in 2002 included 100t for each Community plus 3 years catch history.

Communities with low quotas argued for more noting previous catches high without landings should be considered.





EQUAL SHARE PLUS 3 YEAR CATCH SHARE

	100 T MIN	PERCENT	QUOTA	COMBINED
ENS	100	2%	29	129
PAFFA	100	3%	51	151
LUN/QUEENS	100	3%	43	143
SHELBURNE	200	3%	47	247
YARMOUTH	100	54%	830	930
DIGBY	100	32%	490	590
SW/NS	100	4%	60	160
TOTAL	800	100%	1550	2350

JPA

Limited data available for science.

JPA initiated in 2002 for fishers to collect information on size and sex composition.

Two communities tasked through JPA with additional quota to collect data.

Additional quota of 700 t permitted.

2003

Management consultations not completed.

Expect to maintain current effort with no increase.

Maintain Community quotas but implement quota overrun provision

Continue with additional samples through JPA for the five year period.